# **Utah Copper Company**

### METALLURGICAL DEPARTMENT

GARFIELD

UTAH

HISTORY OF

ARTHUR PLANT

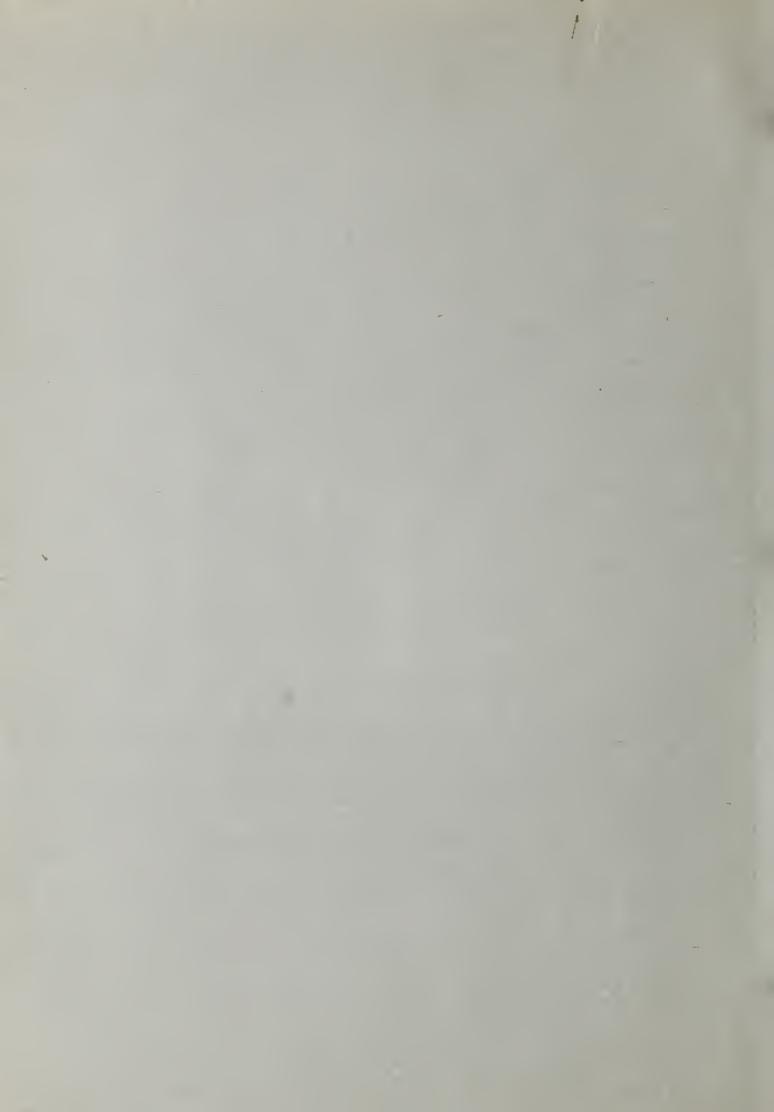
MAGNA PLANT

AND

LEACHING PLANT

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October 24th, 1923.



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The Arthur Plant opinishly known as the Total Convotid on till is located on a track of spreasing sale TOO conof land, establish bout group between the lapon Pirms as are their commess. Construction of the Poston Consolidate tarsed during My 1906 and was completed during suly goe has finally not in open the hell consisted of 12 outs having a total milling departy of uppraximately 1,000 tune po-TA hours.

accepted by the Etch Copper Commany who leave better to the comming of the installation of an interest to the installation of an interest to the order of greater consisty. There is no investigate to complete descriptions, also utarted further appure 1909.

di consider of the verious changes to equipment and methods during the life of the arthur lient is confided on two separate describents, together with a chapter of miscoli name it as, as follows

Course Crushing Deportment
Fins Crushing Deportment
Gravity Consentration Deportment
Flotation Concentrate Deportment
Viscous Gravity

# COARSE CRUSHING DROSETTEET

Under the control of the coston Consolication at the steel bin haring a case of interpolation and the steel bin haring a case of interpolation the steel bin the result of the veyor y mades of for a feeder then to the steel of the course crushing outpoint.

The Ut h Corner Company made to the person the storing bin, but they did install to arious pening to separate the constant of government the separate the constant of government the number of government the number of government the number of government of government of the number of government of

to crushing machinery.

To over-lapping and A steel pan conveyors were intilled to carry the coar e ore from storage bins to crushers, and two 42 inch belt conveyors were placed to handle the finer intial. In both cases the ore was fed to these conveyors by an action of steel apron reeders which by the way were the only machines in this department that ere not discarded by the present company.

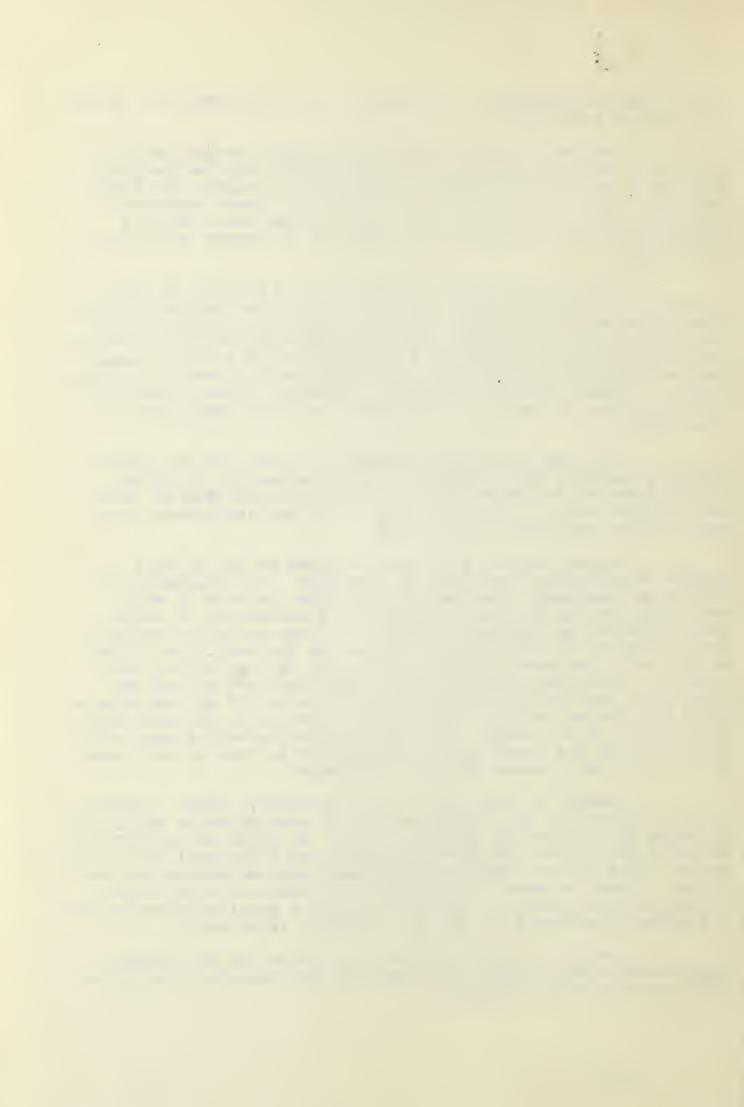
The set of 72"x20" defield rolls and one 36 inch eveter are a dei during August 1911, for the purpose of handling oversize from the Gates gyratory crushers. In June 1912 the Cates gyratory crushers were replaced with the No. 8 lectully exterior one dditional 36 inch elevator and two additional of 72"x20" Gate all rolls, put in operation during the late onto third lectully crusher was installed during June 1913 building to house this machinery was also completed in 1913

ith the additional equipment as outlined the coarse crushing capacity was increased from approximatily 3,000 to 16 000 tons per 24 hours, the same being reduced from 12 inch inch in size. Fo further changes of any importance are in this department until 1919.

During January 1919 what is known as the primary core cru hing plant was put in operation. New equipment at this time consisted of a Heulett car cumper capable of automatically dumping approximately 440 cars of ore per 24 houring installation was made primarily to increase plant capable of the primarily to increase plant capable of the primarily inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary inter and early spring months as the condition of the primary cases. However, as the condition of the primary coarse capacity for sizes up to 54 inch and production to 6-1/2 inch. Dins, feeders and conveyors were plant to deliver the ore from this department to what is now known the secondary coarse crushing department.

Changes at this time in the secondary coarse crush a riant consisted of the removal of one 36 inch elevator which was replaced by a system of conveyor letts. In entra set of 71° coarfield rolls were installed tog ther with 8 Hitchell wibratory creens, the latter replacing stationary screens heretofore encloyed. These changes in equipment ere made not only to increase tornage capacity, but also to make a greater reduction of the product delivered to the fine crushing department.

Adequate over head crane facilities and additional rigger shed capacity were also provided for landling repairs to all coarse crushing equipment.



During ferch 1921, four Mitchell vibratory screens installed underneath the coarse ore bins, for the purpose of handling the undersize from 1-1/4 inch grizzlies. The undersize from these screen was sent direct to fine crushing plant, aliminating a portion of tonnage which was previously delibered to 72"20" Gerfield rolls. With the completion of these latter change his department is now capable of handling approximately 20,000 tons per 24 hours

#### ILE CRUSHING DEPARTMENT

Where the observable of the Boston Consolidated this reportment consisted of one steel ore bin having a capacity of the oximately 13 000 tons, from which the ore was fed to Hisson by means of Challenge feeders. Twenty-four of these stands constituted a unit, the capacity of same being rated at the per each 24 hours or a total of 3,276 tons per day for revided no lost time was recorded.

The Utah Copper Company began hanging up these stamps in October 1910 and started replacing same with two 37-1/2"x15" derining rolls per unit for preliminary grinding and two 6 foot the antilla per unit for regrinding appron feeders were placed to deliver feed from storage bin to rolls and six 3 x4 impact some per unit ere installed to obtain the required sizing. One 24 inch elevator per unit was also installed to handle for the conversize which was a circulating feed to rolls. Of the 6 impact screens in operation, two were used at the fine bin feeders and the remaining four were placed as return screens to handle product from 24 inch elevator. The placing of this requirement was completed during August 1912.

During the winter of 1916-1917 each unit was arranged to that water could be added to the feed delivered to both feeder and eturn Impact or ens. This was done to eliminate, as much as cossible, the trouble experienced with wet and sticky ore during cold weather, the same having a tendency to blind screens, and launders thus greatly reducing milling capacity.

During the early part of 1917 all feeders used for delivering ore from storage bin to 37-1/2"x15" Rolls were increasel in lidth from 30 inches to 60 inches. This was done to obtain a more steady flow of ore at the narrower opening associatel to the 30 inch feeder caused the ore to pack around the feeder in the fine bins. The change has proven very satisfactory.

Then it became necessary during the war to increase production beyond limits hereto fore maintained considerable trouble developed on accound of excessive over-load on all 200 L.F. motors used to drive rolls, Chilean mills and Impact screens consequently in January 1918 the work of replacing these motors ith 300 H.F. motors was started and completed during lay of the name year. At this time the 200 H.P. motors on units 12 and 13



were not changed as 3 was ball mills had replaced 3 rolls on these two units, the former machine being equipped with individual motors.

During February 1921 work was started which involved removing all feeder Impact screens and installing them in the same position as that occupied by the 4 return Impact screens previously described, thus permitting the ore to be delivered direct from fine bin to 24 inch elevators, thereby obtaining greater screen efficiency without increasing the screening area. This change was completed during Narch 1921.

For the purpose of carrying on experimental work in connection with the flotation concentration of lill Slime, two No. 86 Marcy ball mills were installed to take the place of 37-1/2"x15" Garfield rolls on Unit 13. The first of these mills was put in operation during May 1915 and the second during the following October. A third Marcy was also installed on unit 12 during August 1915, the same replacing one 37-1/2"x15" Garfield Foll. The Marcy mill is a wet grinding machine having the dicharge end fitted with a fine grate covering practically its entire surface. The feed enters the mill through the trunion and is reduced to fineness by means of steel balls

These mills eliminated the use of Impact screens and the 24 inch elevator otherwist required for handling the circulating load to rolls. During arrly experimenting with these machines it was found that when landling fine bin feed exclusively (maximum size 3/4 to 1 inch), the necessary fineness of product could not be obtained without greatly reducing tonnage To remedy this condition a drag classifier was installed for each mill to which a portion of the first spigot of primary hydraulic classifiers was delived to the drags serving as a dewatering machine, discharging the eigenvalue of the bal mills. The this arrangement greater capabity was maintained

The Parcy 'll on Unit 2 was discarded during June 1920 and replaced the following much with a 54"x20" Roll. Bo h Mar y Mills on unit 13 were carded during December 1920, and replaced with to 37.1/2"x15" rfield Rolls the following month. A 30 inch elevator was also installed on this unit to replace the 24 inch elevator which as in use prior to the placing of the Marco mills. It is atory screens were used in place of Im. to, but the light atory screens were used in place of Im. to, but the light property during May 1,22. Mitchell we did not prove a tiefactory in the local series of Im. The local serie

During the dle proof 1916 work was started on a new slime flotation plane to be sed in the treatment of mill slime by the flotation seed that greater efficiency and betained from treating the

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finer material than was possible to obtain by gravity concentration of either course or fine material. Thus it became necessary to increase the crushing efficiency of this department by the addition of equipment capable of producing economically, a kinum smourh of slime feed suitable for flotation. The grade of this fied being a minimum percentage plus 65 mesh Tyler Standard forcen.

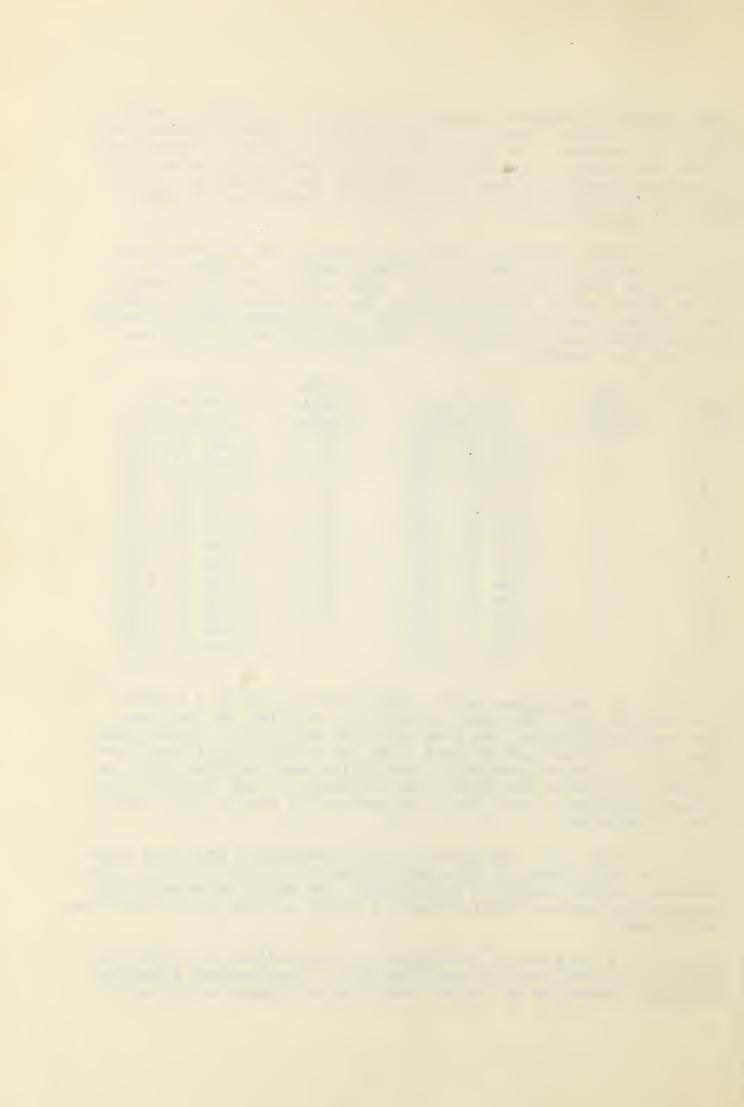
After investigating data covering the various kind of machines in this service at other plants, 7'x10' tube rill of the lower and Fining Co. type was selected. Twenty-lix of these mills — 2 tube mills per unit were put in operation during a period from larch 1917 to "ebruary 1918 inclusive. The following tabulation shows when each individual mill was released for service:

	Tube		Tube	
Init	Will	Date Put	1111	Date Put
To.	Timber	nervice	lumber	In Service
1	1	ley 20, 1917	2	Hey 5, 1917
2	1	lpr 12, 1917	2	.pr 10, 1017
3	1	Tur 21, 1917	2	Jar 21 1917
	1	Cet 11, 1917	2	Oct 12, 1917
5	1	Oct 31, 1917	2	Oct 31 1917
6	1	ov 26, 1917	5	Nov 26, 1917
7	1	Dec 17, 1917	2	Jan 6 1918
3	1	Jan 7, 1918	2	Jen 7 1918
9	1.	Jan 7, 1918	2	J n 7. 1918
10	1	Jan 22 1918	2	Feb 1, 1910
11	1	Feb 1 1918	2	Feh 1, 1915
12	1	Feb 2 1918	2	Feb 2 1918
13	1	Feb 2, 1918	2	Teb 22, 1915

To feed these mills with material having a proper consistency, one 7'x9' drag classifier similar to the Dorr type was installed at the head of each tube mill. These drags devatered a classified product from hydraulic classifiers delivering a coarser product to tube mills and overflow or fire to Dorr thickeners for flotation treatment. Four 6 inch centrifugal sand pumps were put in operation to handle this overflow as required.

ith the installation of the foregoing grinding machinery the efficiency of this department was increased to a considerable extent and as a consequence the basis of normal mill tunnage was advanced during Earch 1918 from 7,800 to 16,000 tons par 24 hours.

ith pebbles and were driven with 75 H.P. motors while the remaining 4 operating on Units 2 and 3 were changed ith balls



which required motors having 150 H.P. capacity. These mills were operated in this manner from the time they started until August 1919 when the work of changing from pebbles to balls commenced. This work involved equipping such mills as were changed, with 200 H.P. motors as the 150 H.P. type wriginally used with ball grinding mills were considerably overloaded at times and caused some trouble. Equipment of 22 mills with 200 H.P. motors and changing grinding medea from pebbles to balls was carried out according to the following schedule:

2 Tube Mills changed August 1919
4 " " " October 1919
8 " " November 1919
1 " " December 1920
3 " " October 1922
4 " " March 1923

In the foregoing paragraph it was pointed out that the original installation consisted of 2 tube mills per unit, but various units were later equipped with a third tube mill, the same being put in operation according to the following schedule.

Unit 4 December 1919
Unit 3 January 1920
Unit 11 November 1922
Unit 8 May 1923
Unit 9 September 1923.

The same type of drag classifier as originally installed was also placed for accommodating each of these additional tube mills.

The use of certain Chilean Mills was discontinued during 1922 and 1923. Altho they were not removed from their original location in the fine crushing department. The following tabulation shows the identity and time of shutting down these mills:

Unit 12 2 Mills July 1922
Unit 3 2 Mills October 1922
Unit 11 2 Mills February 1923
Unit 4 2 Mills February 1923
Unit 9 2 Mills September 1923

Necessary crane facilities were added and additional rigger equipment provided for maintaining repairs. It was also necessary to makeextensive changes in mill handling to accomodate these tube mills and apparatus necessary to their up keep.



9.

tracted from 12th a second of a range of a second tracted from 5 to a second a rough changer and a contract charge contract during the period mandates.

		Tonnage	Treat ea
Yea		Per Month	Per Oby
1910		85173	280 <sup>g</sup>
1911		79616	2615
1912		15504	2063.
1913		231391	251
1914		25822	0293
1915		293618	9070
1916		404208	
1917		455400	
1918		461308	
1919		471092 46 <sub>200</sub> 7	15183
1921		400900	
1922		455031	15100
1923	(1st 9 months)	53=000	

The entire plant was do not round to the European War and 1915 on account of the European War and 1920 hier to sulted in again the ting do not he ptire plant 1921 to April 4th 1922.

#### TENTENT CONCENTRATION DEPARTMENT

Under Boston Consulidated ownership the field department was delivered direct from Wisson. Thing is a light hydraulic classifiers per 111 m/s. The classifiers as sent to 22 liftley tables pur an introduced to bin, and tailing to a line firm overflow on a line we delivered to 21 deals of the first underflow from tanks using pages tack to put to waste.

The remodelling of each mill unit as inage to the Utah Copper Comeany consisted of installing 24 G each reghing tables to which the undersize from impact of a delivered direct. The Garfield tables mentioned are a modification of the St ndard Wilfley type. One 30 inch elector applaced on each unit to carry tailings from roughing tables to inhards—Janley four spigot hydraulic classifies of an extension of the Boston Consolidated. One 13 inch elevator pur unit, was installed for delivering consentrate from Garfield rougher tables to one 3 spigot hydraulic classifier of per unit.



these classifiers being utilized from Boston Consolidated mill. Two additional Wilfley tables per unit were placed to handle a circulating load from the 3 spigot classifiers but these were abandoned during the latter part of 1917.

Four Richards Janney 5 spigot hydraulic classifiers per unit were installed to handle a product from the 4 spigot machines, the former classifiers discharging spigot products to 24 Ishell Vanners per unit, also installed by the Utah Copper Company. Four additional Ishell Vanners were also placed to treat overflow from 3 spigot classifiers, but these were removed in September 1917. The Utah Copper Company utilized all Callow settling tanks formerly employed by the Boston Consolidated, but installed 4 additional per unit, these machines being used to settle mill slime. Thirty-six Ishell and Johnston Vanners per unit were installed for treating this slime and two 8 inch pumps placed for returning tank overflow from sumps to concentrating machines.

Remodelling and installing the above equipments tarted during August 1910, the various mill units being completed and put in operation according to the following schedule:

Unit 1 started operating March 1911
Unit 2 started operating April 1911
Unit 3 started operating July 1911
Unit 4 started operating July 1911
Unit 5 started operating August 1911
Unit 6 started operating October 1911
Unit 7 started operating January 1912
Unit 8 started operating February 1912
Unit 9 started operating April 1912
Unit 10 started operating May 1912
Unit 11 started operating June 1912
Unit 12 started operating July 1912
Unit 13 started operating August 1912

At the completion of this installation in August 1910 the mill was treating about 8,000 tons of ore per 24 hours and during the following period prior to later remodelling treated more than three times its original capacity under Boston Consolidated ownership.

The next improvement inaugerated was the installation of a Gravity retreatment plant, the construction of which started in March 1912, and was completed in August 1912. New equipment installed in this plant consisted of two 24 inch elevators, 2 Richards-Janney 5 spiget hydraulic classifiers, two 6 spiget classifiers of the same type, 8 Wilfley tables and 8 Johnston Vanners. The object of this plant was the treatment of Vanner concentrate for the purpose of eliminating all excess silica possible in order that the tonnage of concentrate shipped for smelting might be reduced and thereby obtain a reduction of total smelting cost. This plant was abandoned in August 1920, after



sand vanners were discontinued, and was finally torn out during the spring of 1923.

During the period devoted to the installation of tube mills in the Fine Crushing Department an extensive campaign of remodelling was also inaugerated in the Gravity Concentration Department. This remodelling consisted of changing 18 inch and 30 inch elevators from wood to concrete housings. A concrete floor was built directly above the Garfield Roughing tables on which was placed two Wilfley tables formerly in use, and two additional tables as new equipment. Concrete launders replaced those of wood for carrying table products to main tunnel launder. The main tunnel for carrying various mill products was enlarged and concreted throughout. A concrete floor was also built directly above tube mill drag classifiers, to which the Richards-Janney 5 spigot hydraulic classifiers were moved from their former position back of the 4 spigot machines. A concrete floor and pillars were also installed in that portion of the mill building occupied by vanners treating sands from 5 spigot hydraulic classifiers.

The climination of Slime Vanners started during Narch 1917, and continued until May 1918, when they were entirely abandoned, as the slime flotation capacity at the latter date was sufficient for handling this material. During June 1920 two Richards-Janney 4 spigot classifiers were abandoned on each mill unit because a good portion of tonnage formerly handled by Chilean Mills was diverted to tube mills. The use of Sand Vanners was discontinued in August 1920, all of these machines being torn out during 1922. These machines were no longer needed after adopting the practice of regrinding and treating all gravity tailing by flotation.

Unit No. 12 was remodelled to provide drag classifiers fiers as a substitute for Richards-Janney hydraulic classifiers formerly employed, two 4 spigot and four 5 spigot classifiers were abandoned. This change was completed and the unit put in operation during July 1922. During August 1923 the work of installing three 12'x16' drag classifiers on Unit 4 was completed. These drags eliminate the use of two 4 spigot and four 5 spigot hydraulic classifiers and will permit the preparation of slime for flotation without previous dewatering by Dorr thickeners.

# FLOTATION CONCENTRATION (Treatment of Vanner Concentrate)

During the early part of 1913 an experimental laboratory was erected at the North end of the mill. This structure consisted of an oil storage room, a room in which to make flotation experiments and a room equipped for the purpose of making chemical analysis of cils submitted for testing. From experiments carried on in this department the laboratory type Janney flotation machine was developed which later resulted in the con-



struction of commercial machines on the same principle.

Experimental work at this time was confined to the development of a flotation process by which low grade vanner concentrate could be treated to eliminate excess silica and by this means secure a reduction in smelting cost. The vanner concentrate contained an average of appreximately 50 percent inscluble which not only increased the tonnage shipped for smelting but resulted in a penalty charge besides. A successful method of treating this vanner concentrate was worked out during the early part of 1914.

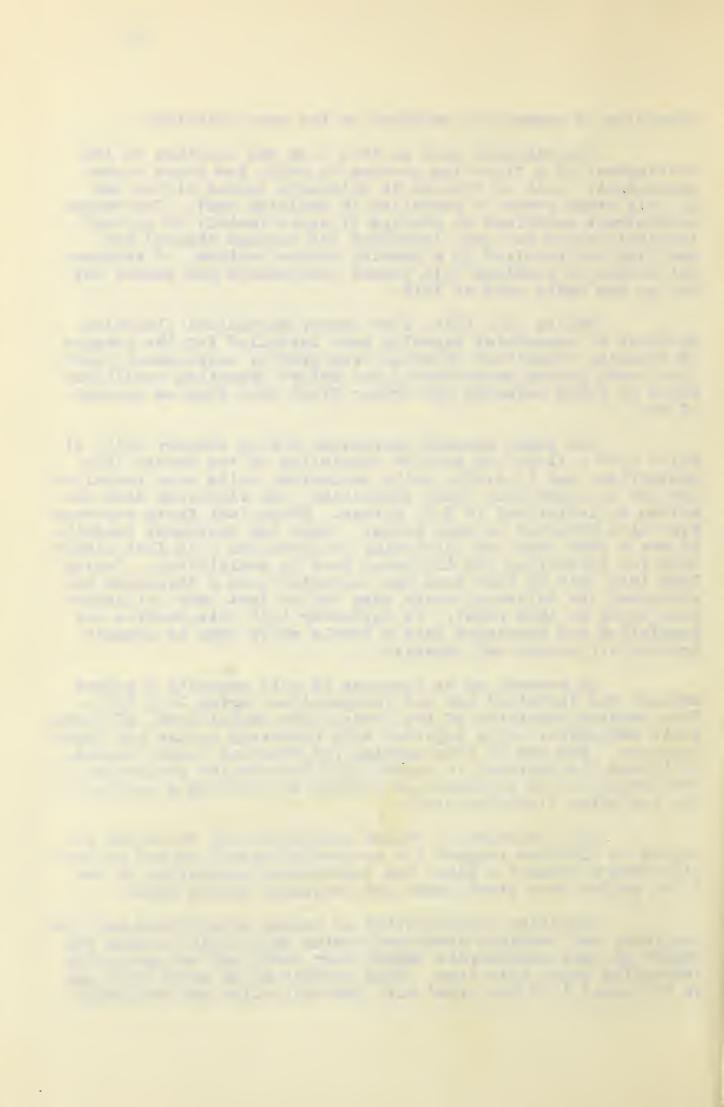
During July 1914, four Janney Mechanical flotation machines of commercial capacity were installed for the purpose of treating classifier overflow from gravity retreatment plant, (Low grade vanner concentrate) but before operating conditions could be fully adjusted the Arthur Plant shut down on account of war.

The plant resumed operations during January 1915, at which time a flotation machine consisting of two Janney type emulsifiers and 13 single spitz mechanical cells were installed and put in operation. Each emulsifier and flotation cell was driven by individual 10 H.P. Motors. Mechanical froth removers were also attached to each spits. Other new equipment installed was a cone tank for thickening the feed and a 20 foot sludge tank for delivering the thickened feed to emulsifiers. During June 1915 this 20 foot tank was converted into a thickener but abandoned the following month when two 44 foot Dorr thickeners were added to this plant. In September 1915 this machine was remodelled and converted into a double spitz type to promote greater efficiency and capacity.

On account of an increase in mill capacity a second machine was installed and put in operation during July 1916. This machine consisted of two Janney type emulsifiers, 15 double spitz mechanical cells together with necessary motors and froth removers. The use of this machine for treating vanner concentrate was discontinued in August 1917 because the production of such material had decreased on account of starting a portion of the new slime flotation plant.

The treatment of vanner concentrate by flotation required an alkaline reagent for successful operation and to provide such a reagent a plant was constructed consisting of two 7,500 gallon wood stave tanks and necessary mixing vats.

Flotation concentration of vanner concentrate was discontinued and machines abandoned during April 1919 because the amount of such concentrate became very small and was gradually decreasing about this time. This product after April 1919 and up to August 1920 was mixed with the mill slime and treated in



the Tline Wlot tion Flant.

# FIOTATION CONCERNATION (Slime)

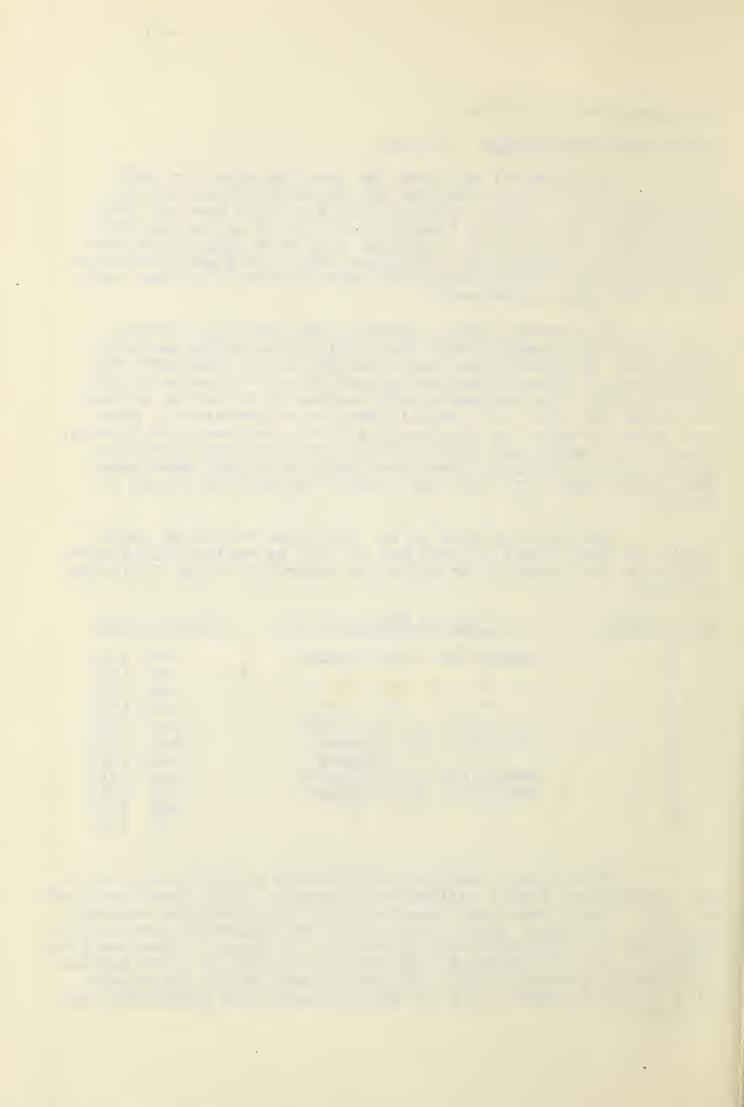
in the line of constructed and put in speration on unit 13 during lay 1915. These machines consisted of 2 rows of flotation cells, each having 2 emulsifiers and 15 mechanical flotation cells. Callot cone tanks and a 20 foot sludge tank were intalled for handling the thickened pulp. In August and September 1915, to 75'x12' Porr thickeners replaced the cone tanks the latter being abandoned

In February 1916 a pyramid mechanical air machine corsisting of 12 emulsifiers and 30 flotation cells was put in specifion. Foot Blower was included in this equipment for augilying the present air introduced through a canvas blanket in the coitz. The successful application of flotation in treating line was worked out on this machine and immediately steps are taken towards the construction of a plant having sufficient that to handle all the produced from milling operations. The taken the construction of a plant having sufficient and the perfect of the produced from alling operations. The taken the produced from alling operations are the pyr mid machine had proved a success.

Construction work on the new sline flotation plant began the latter part of 1916 and as fast as various units were completed they were put in operation according to the following schedule:-

init Number	Type of Hashine	Date Charted
1 2 3 4 5 6 7 8 9 10 11	Cleaner   Cleaner   Cleaner   Cleaner   Cleaner   Cleaner   Cleaner   Cleaner   Cleaner   Cougher   Cougher   Chanical - Air Rougher   Cleaner   Cleaner	Teb. 1918 Aug. 1917 Feb. 1917 Feb. 1917 Iny 1917 May 1918 July 1918 Aug. 1918 May 1918 May 1918 May 1918 May 1918

This plant including the building and flotation cells was constructed almost entirely of concrete. Cast iron impellers and cell liners were used together with vitrofied pipe wherever possible. Rigger shed, pumps, sumps and apparatus for ranufact uring air blankets were also installed. A blo er house was also included in this equipment, the same containing 12 Roots blowers each having a capacity of 10,000 cubic feet of air per minute of 5 pound, pressure. Six of these blowers were abandoned early in 1923.



The first installation, it will be noted, included some straight air machines, these however, were converted to mechanical air cells during August 1918 because the straight air cells were not as efficient metallurgically as the mechanical - air type

For the purpose of delivering feed of the proper consistency to the flotation plant a series of Dorr thickeners were installed, the same replacing callow cone tanks originally used for settling slimes. These Dorr thickeners were put in operation according to the following schedule:

Tank Number	Size	Date put in Operation
1	75'x12'	Aug. 1917
2	19	Aug. 1915
3′	79	Sept. 1915
4	19	Oct. 1916
3456	, 28	Nov. 1916
7	75 'x18 '	Feb. 1917 May 1917
9	11	Aug. 1917
9	88	Feb. 1918
10	The state of the s	Mar. 1918
11	t9 99	July 1918
12	7	May 1918
13	H H	June 1918 Apr. 1918

With the starting up of Unit No. 4 during August 1923 under a flow sheet by which flotation feed is prepared without Dor; thickener as previously explained, No. 9 Dorr thickener was abandoned.

When construction work started on the Slime flotation plant new ground was purchased and made ready to provide a separate pond for the disposal of flotation tailing. A concentrate launder about 1/2 mile in length was also built and put in operation during April 1918 for the purpose of carrying the waste material from the mill to the new pond. This portion of the pond has since been filled up and the launder is only used occasionally for wetting down tailing dust. Early in 1919 a new launder was constructed to carry flotation tailings directly across the old tailing pond to the North pond. This launder being still in use.

During the early part of 1918 a new laboratory was erected for the purpose of housing equipment used in making various metallurgical tests in connection with mill operations, etc. This building consisted of a chemical room, office, oil storage and flotation test rooms.



In connection with the installation of flotation equipment the following tanks were erected for the purpose of storing oils and reagents necessary to the operation of such process:

#### Cil Storage

Number of Tanks	Gallons Capacity Per Tank	Gallons Total Canacity
94437	37600 14400 5700 440000 47000	338400 57600 22800 1320000 47000
Total		1785800
Acid Storage		
2 1	37600 5 <b>70</b> 0	75200 5700
Total		80900

During the early part of 1917 a plant was built for the purpose of reconstructing certain oils necessary to flotation treatment. At that time this plant consisted of one 500 gallon still, but three stills of the same type and capacity have been added since. This total equipment was completed about the time that flotation was operating to full capacity

An experimental flotation plant was installed on Unit 12 and 13 during the latter part of 1920. This plant consisted of two Improved Janney Mechanical Air Cells, each having one emulsifier and 13 flotation cells. A Callow pneu matic air machine was also installed on unit 13 during the same time. The Callow machine was shut down in the early part of 1923, but the Janney machines remained in operation and are being used for testing out various oils, reagents, flow sheets, etc.

During the latter part of 1922 the work of replacing cast iron liners with adamant silica blocks, was started. This was not finished until the early part of 1923, the length of time required being due to remodelling only a small portion of the plant at a time, so as not to interfere with capacity. During the early part of 1923 the work of changing cast iron impellers to rubber impellers was completed. Both of these changes were made to decrease the cost of operation by substituting material that would more readily withstand the action



of sulphuric acid used in the process.

#### DEMATERING OF CONCENTRATE

Under Boston Consolidated ownership this department consisted of 10 concente bins of about 250 tons capacity each from which concentrate was loaded in cars by means of a clam shell. A sump at one end of these bins was used for collecting overflow which was in turn pumped to 1,000,000 gallon reservoir supplying mill water.

The Utah Copper Company built 16 new concrete bins having practically the same capacity and turned the last one over to operation during August 1912 at which time the 10 bins formerly used by the Boston Consolidated were abandoned. An electric crans operating a clam shell bucket was installed, the same replacing clam shell formerly used.

the arthur Plant a serious difficulty arose in handling the consentrate produced, in as much as it contained a considerable amount of slime material and more or less oil which rendered it impossible for dewatering with means employed up to this time. Consequently a filtering system was installed for reducing the moisture content to a point suitable for economical handling, both at the mill and Stelter. This plant consisted of Dorr thickeners, elevators, drag classifiers, filter vacuum pumps, reservoirs, conveyors, etc. A suitable building to house filters, drags, elevators and vacuum pumps was also erected.

Equipment necessary to this plant was put in operation according to the following schedule:

# Dorr Thickeners

No.	Size	Date put in operation
1	75'x18'	Apr. 1917
2	tr	Aug. 1916
4	er	Mar. 1917
5	11	Sept 1918 Dec. 1917
5	H	Sept. 1917
6	87 88	July 1917
9	100'x12'	Aug. 1917
10 .	11	Apr. 1919 June 1919

Four of the 75 foot by 18 foot thickeners were abandoned by this plant during the latter part of 1922 and early



part of 1923. The removal of this equipment was possible after discontinuing the use of 20 pounds of oil in flotation treatment as heretofore this quantity of oil resulted in a concentrate that was at times very hard to settle.

During May 1923 a 44 foot Dorr thickener was installed and another placed in July following, both of which are used for settling overflow from drag classifiers which was formerly directed to the larger thickeners along with flotation concentrate. These two thickeners were moved from the former flotation retreatment plant which was abandoned during April 1919 as previously mentioned.

Vith the installation of the first Dorr thickener the placing of 14 'x14' Portland filters was also started. When finished the filtering department consisted of 12 Portland and 2 14 foot American filters, these machines having been put in operation according to the following schedule:

	Filters	
10.	Nine	Date put in Operation
1 2	Portland	Aug. 1916
	P9 65	Mar. 1917 June 1917
3456	.2	Oct. 1917 Nov. 1917
7	(8) (9)	Nov. 1917 Dec. 1917
g	H (I	Mar. 1918 Apr. 1918
ii ii	AA	Apr. 1918 June 1918
12	merican	Sept. 1918 Nov. 1919
2	11	Oct. 1919

In February 1918, four drag classifiers equipped with vacuum at the discharge end were completed and put in open tion. These machines were used to reduce the moisture content of Wilfley table concentrate, which after devatering supplied a thick granular product that was mixed with flotation prior to filtering to gain more filter efficiency.

During August 1919 a concrete reservoir having a capacity of approximately 1,000,000 gallons was added to this department. This installation was made on account of the lifficulty of settling the concentrate product resulting from 20 pound oil treatment.



#### III LL HOUR

# it to be in in

timed from Spenier's Springs Located a half mil. North of mil buildings the stee being followered by means of Byron Tached purpose reservoir of 1,000,000 gallons capacity star from this sering formed a portion of that used by the Unb Comper Compen, until August 1914 when the spring because coronal public tellings. A concrete reservoir having 2 000 000 gallons a posity was constructed about 200 yerds forth at of the mill building and out in operation during a tober 1912. Until august 1914, all water in series of that supplied by Concer's Chrings was pumped from the Nagna Plant The source of the latter plant consisted of springs at the mill and also a supply from Utah Lake which is delivered to the by a small about 40 miles in length. Since August 1914 after has been pumped from Pagns to the Arthur Plant Telegrapic

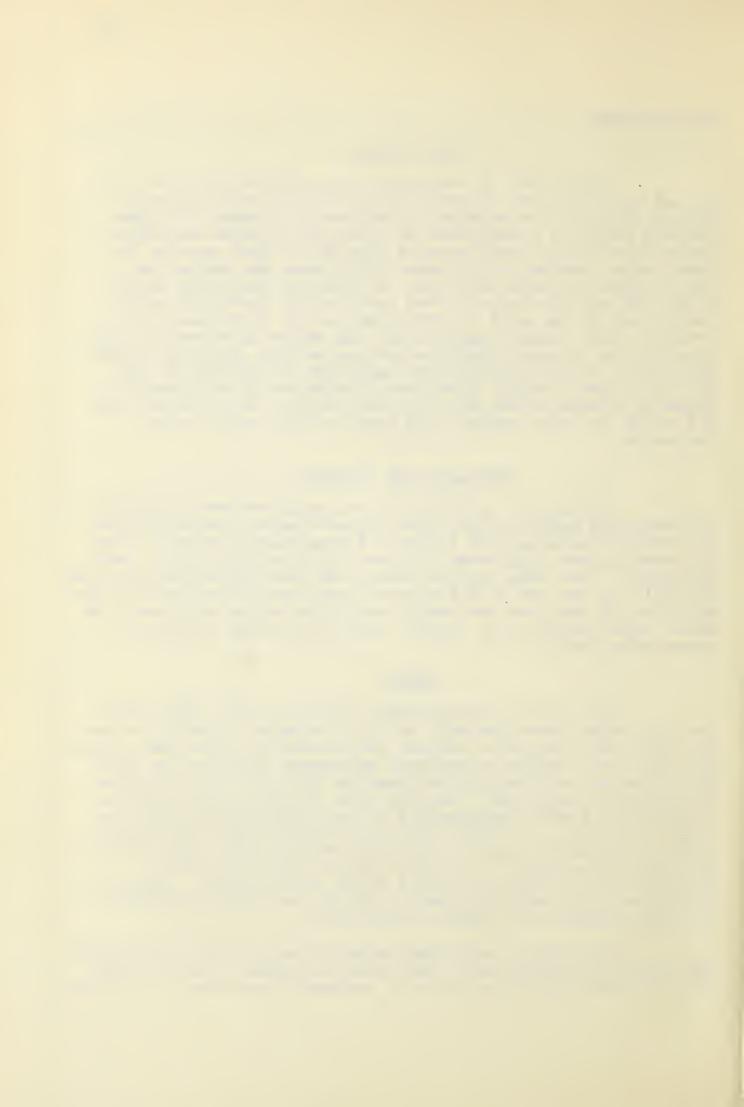
# Saruline and Luiving

It necessary points by the Utah Copper Company and a portion of the oil building set as the as a sampling department where all Europeas were delivered and handled according to the best protion. The assay office erected by the Boston Compolidated is still in use and so for his not been changed except for the idition of love new equipment consisting of an oil assay function. From Electrolite Cutfit, electric drying oven and a steam water still

#### Dowes'

The Bos on Jonsolidated obtained their power from the Telluride Power Company, as did the Arthur Plant also until 1913 about the power company was absorbed by the Utah Power at light Co. Initial electrical equipment consisted of 3000 TV, taken at 44 KV and transformed to 440 volts for distribution in mill and shops. In 1913 this capacity was increased to 4500 KV to use requirements of roll installation and increased form part in 1915 these irresformers were bendened and lessence, and were replaced with modern transformers of 6.000 FT capacity. In 1916 a second bank of 6.000 E capacity and secondary switch boards were also instilled at the lim, making all circuits automatic.

In 1-17 an additional substation of 9,000 MM Capacity built to furnish power for flotation plant; this station bring proctically a luplicate of equipment previously installed



This brings the available capacity of both stations to 21,000 kW, some being received at 44 KV and delivered to motor at 440 volts,

In 1920, the then existing contract with the Utah Power and light Company, for delivery of power at 44 UV was annulled and a new contract entered into for delivery of same at 130 KV. This necessitated construction of an out-door station and the installation of transformers of 50,000 KVA capacity, at Magna, to transform from 130 KV to 44 KV for distribution to the various plant substations. This equipment was put in service with 25,000 KVA capacity in 1922 and as finally completed with 50,000 KVA capacity early in 1923

#### Accessory Buildings

The following buildings were either built new antirely, or remodelled to accommodate increased milling capacity

#### Administration

This building is a two story structure 38 feet 8 inches wide by 145 feet long. It replaced a former office building and was completed in April 1918.

# Hespital

The office or administration building formerly used was remodelled and fully equipped as a local hospital. Competed during latter part of 1918

# Garage

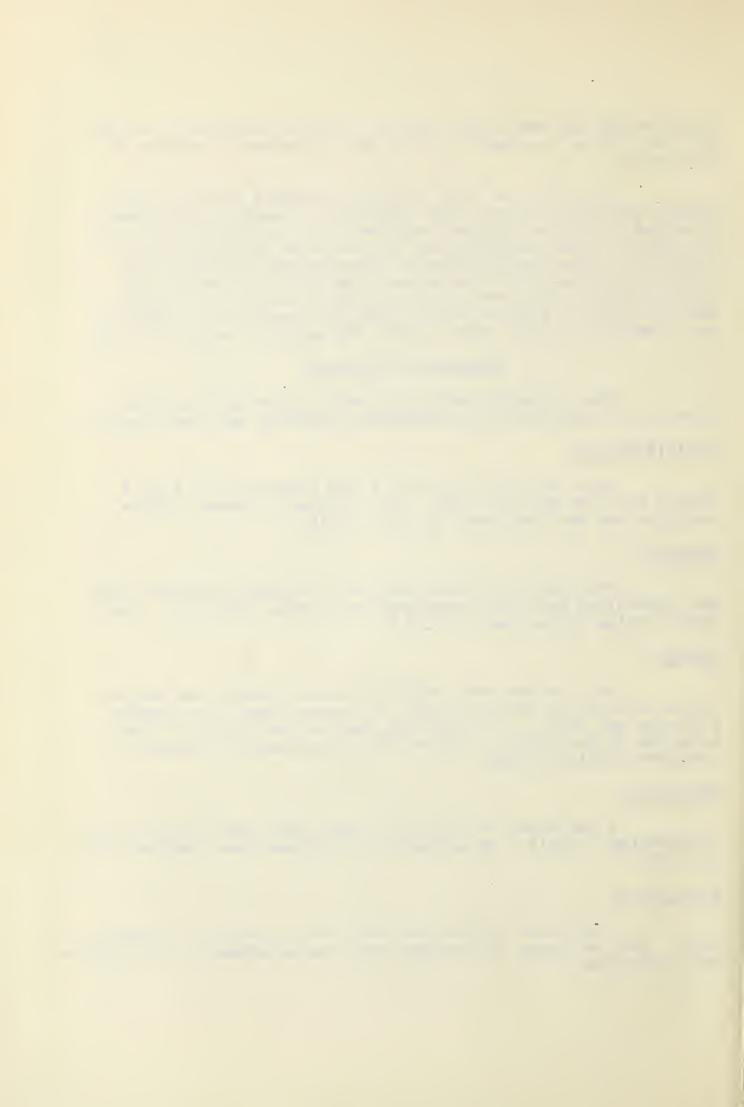
during the latter part of 1915. To house these auto trucks a sarage was built. The building as 24 feet wide, 58 feet long and 12 feet high constructed of corrugated iron and completed early in 1916.

# Warehouse

A one story building 120 feet long with basement was constructed in 1910. An extension of 90 feet was finished during 1918.

# Time Office

A one story brick structure was finished in January 1923. This building is divided into two departments, time office and employment,



## Shop Buildings and Equipment

### Pigge. Shed

The original building was 52 feet 8-1/2 inches wide, 30 feet long and 26 feet high. Steel frame, covered with corrugated iron. Completed in 1913. In 1917 and 1918 an extension of 131 feet length by 47 feet in height was made. Part of this extension furnished quarters for Tin shop, Electrical repair shop and also pipe fitting shop. A second extension of 112 feet was completed during 1922. New equipment consists of the following:

Pipe Shop: Landis pipe machine installed 1917

Tin Shop: - Circle Shear installed 1923

J M Robinson 8 ft brake installed 1923

Electric Shop. - Emery Theel installed 1923
2 Segeir Coil forming machines installed 1923

Segier Taping Machine Installed 1923

## Mechine Shop

Original building me a cool tructure, with concrete to bottom of mindows; 42 feet 2 inches wide, 176 feet long and 22 feet high. In 1916 an extension of 32 feet on West and was cate and a second extension of 112 feet on Mast end was completed in 1917. An office building 19 feet by 33 feet as added in 1911 and a tool room 29 feet by 7 feet in 1915. New equipment consists of the following:

1	Drill Press	Installed	1917
1	Automatic Saw Grinding Machine	89	1917
	Automatic Screen Cutting Lathe		1917
	Te Blonde Lathe 21 inch		1917
	American Lathe 24 inch		1917
	Hurtness Flat Turret Is the	H	1917
	Reyseater No 5		1917
	Ecring Will 60 inch		1917
	Prdisi Drill 6 feet	n	1917
	Americal Lathe 48 inch	11	1917
	Emery Wheels	31	1917
ĭ	Show Crane 10 tons capacity	n	1918
	Vertical Turrett Lathe	8	1920
	Press 500 ton	52	1922
	Funch and Shear Machine	II	1923
			and the same

# Boiler Shop

This building consists of an extension to the warehouse building 120 feet long, which was completed in 1916. It



is 50 feet wide and 25 feet 6 inches high. New equipment consist of the following:-

1	Air Hammer 2200 pounds	Installed	
2	Pressure Clamps	ti ti	1917
3	Carbic Generators Model B-2	11	1920
	Bolt Machine 3 headed	**	1920
1	Radial Drill Press	29	1920
	(From Machine Shop)		
1	Electric Rivet Heater Size 32	68	1917
1	" " Size 33	24	1917
1	Ryerson Frittion Saw	98	1917
	Funch and Shear No. 3-1/2	24	1917
a).	Plate Bending Polls #3	32	1917
		ef	
1	Emery Wheel	"	1917
7	Oxy-Acetylene Welding Set-	ff .	1920
		\$8	4
7	Arc Welding Set	**	1920

### Carpenter Shop

This building is a steel frame structure, 60 feet wide, 120 feet long and 16 feet high, covered with corrugated sheet iron. It was completed in 1913. New equipment consists of the following:-

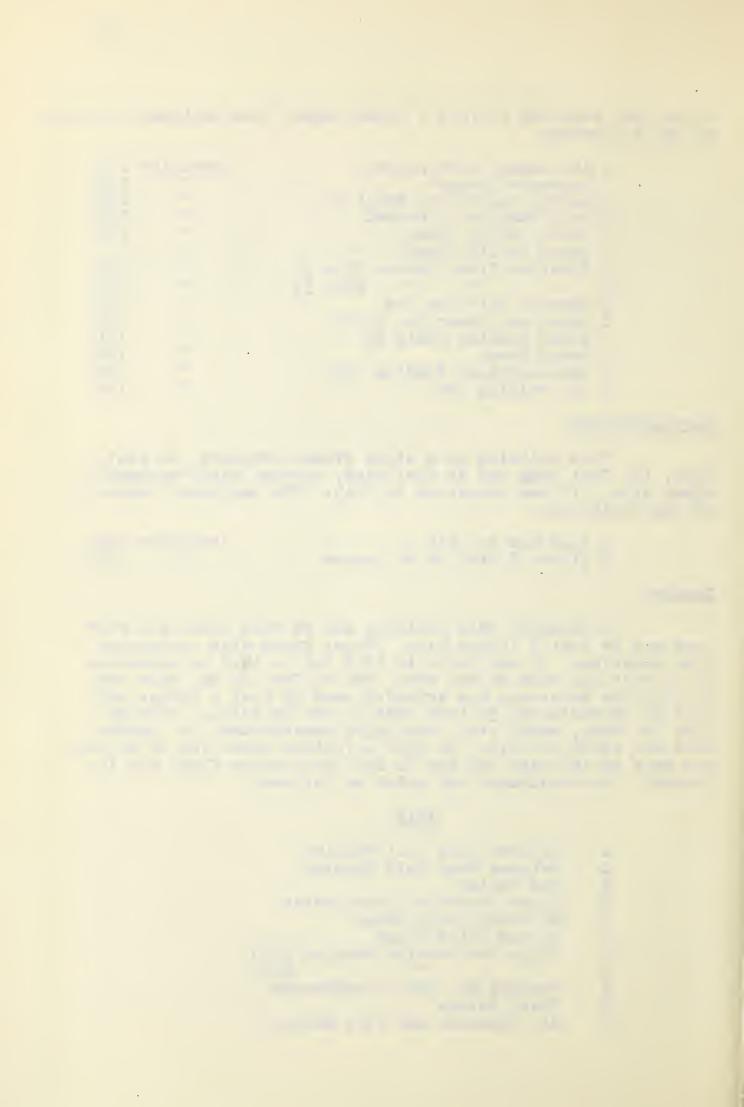
	Band Saw				Installed	1917
I	Planer 8	foot	by 24	inches	\$\$	1917

### Foundry

Originally this building was 20 feet wide, 120 feet long and 14 feet 3 inches high. Steel frame with corrugated iron covering. It was built in 1910 but in 1912 an extension of 15 feet was made on the west and 60 feet on the east end. In 1915 the crane-way was extended east 25 feet 6 inches and also an extension of 30 feet made to the building. Storage bins for coke, sand, etc., were also constructed. A cleaner shed was added in 1914. In 1916 a further extension of 90 feet was made on the east end and in 1917 the charge floor was increased. New equipment was added as follows:

# 1915

1	Osborne Core Jolt Machine
1	Osborne Baby Jolt Machine
1	Rod Cutter
1	Tyler Recording Thermometer
1 .	#2 Stand Batch Mixer
1	15 ton Neles Crane
1	Plain Ton Parming Machine #100
1	" " " " " " " " " " " 101
2	Western El. Cent. Compressor
2	Blast Meters
1	Air Squeezer and Jolt Machine



- 6 ton Pet Scale
- Gyratory Riddle Skull Crusher

## 1916

- Buckeye Oil Heaters
- 2 ton Niles Crane
- Osborne Stripping Plate Machines
- 1211 Herman Jar Moulding Nachine Stripping Plate Machines
- G.E. Centrifugal Compressor T.E. Centrifugal Compressor
- 1 Sand Blast Machine
- 2 Platform Scales
- 15 ton Whiting Grane

## 1917

- Small Core Saw
- Rod Cutter
- Peerless 4000# Hoist
- ILLILLE LZ LZ LG 2 ton Triplex Block
- Ll ctric Magnet for Hoist
- Osborne Air Squeezer & Joli Machines
- 2 ton Whiting Hand Crane
- #7 Whiting Cupola
- Blast Gates
- Air Hoist (Whiting)

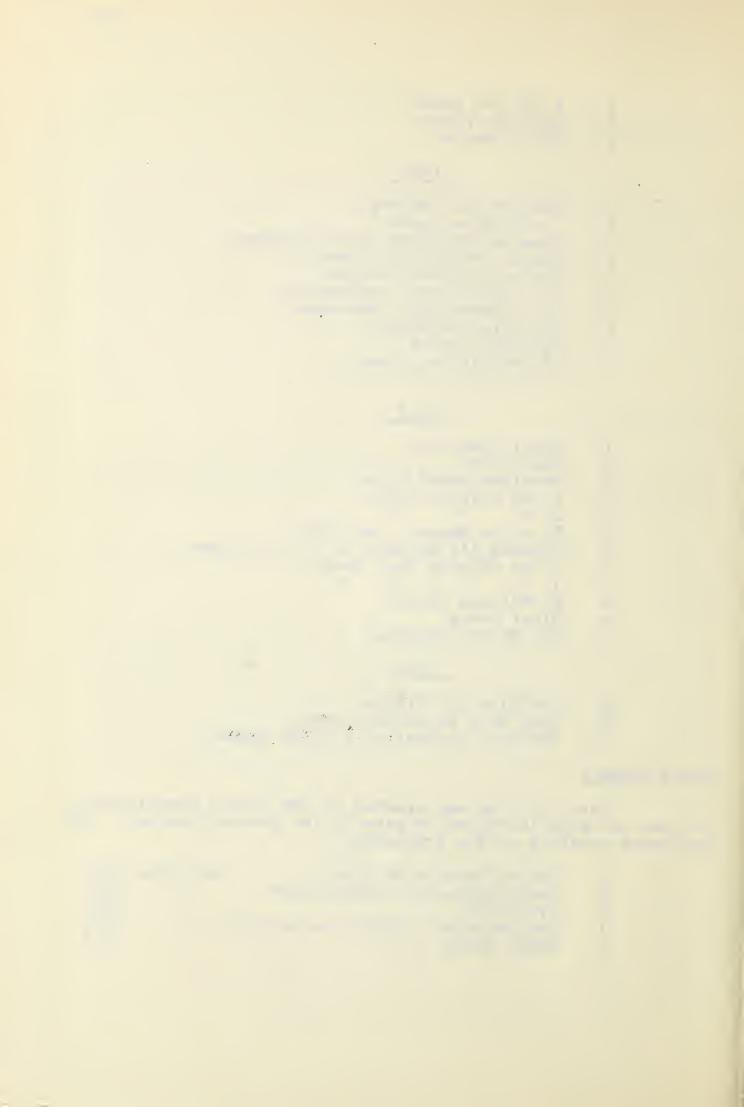
#### 1918

- Worthing Air Riddles
- Link Belt Locomotive Crane
- Electric controlled lifting Magnet

# Breas Foundry

This building was erected by the Boston Consolidated and has not been increased in size by the present company. Hew equipment consists of the following: -

1	Swartz Furnace 42 inch	Installed	1917
1	Worthington Rod Straightener	19	1917
4	Cruciblea	38	1917
1	Duples Hoist 1-1/2 Tons Capacit	y u	1917
1	Emery Wheel	13	1918



## Pattern Storage

This building is of wood frame covered by corrugated sheet iron. I is 64 feet vide, 126 feet long and 36 feet high, and was completed in 1917. Equipment consists of one Sprague electric hoist for handling patterns from various floors.

## Grinnel Sprinkling System

Installed during 1916 and 17 to protect Pattern Storage. Tumber Sheds, Cappenter Shop and Warehouse.

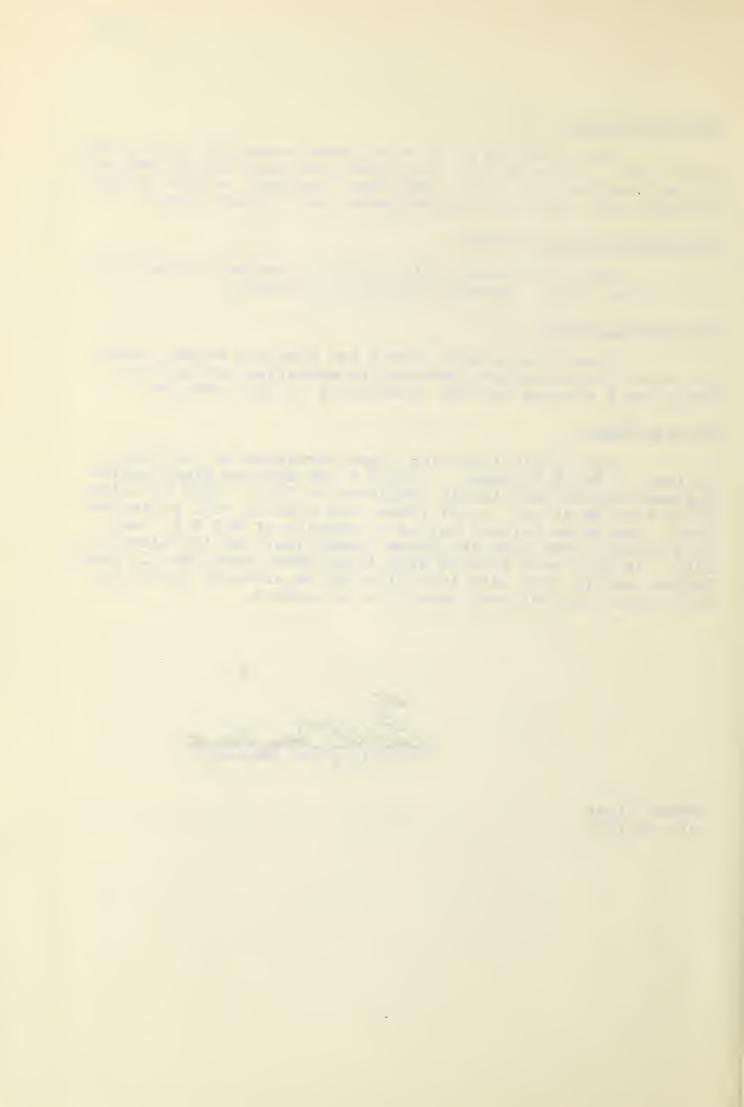
### Industrial Tracks

These tracks were placed for shop and rigger transportation facilities and were put in operation during 1920. There are 2 storage battery locomotives in this service.

### Heating Plant

The original heating plant consisted of two Heine boilers of 420 H.P. each. In 1919 a new heating plant building ing was started and finally completed in 1922. This building is 84 feet by 36feet, steel frame, and covered with galvanized iron. Two Heine boilers having a capacity of 420 H.P. each were brought over from the Magna Power Plant and installed in 1919. In 1922 both boilers were transferred from the old plant. Taylor stokers were also installed and an elevator placed to heist coal from railroad track bin to stokers.

Arthur Plant Oct. 19, 1923



## The wear with

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Le la melto and 1 les et of Salt lent city.

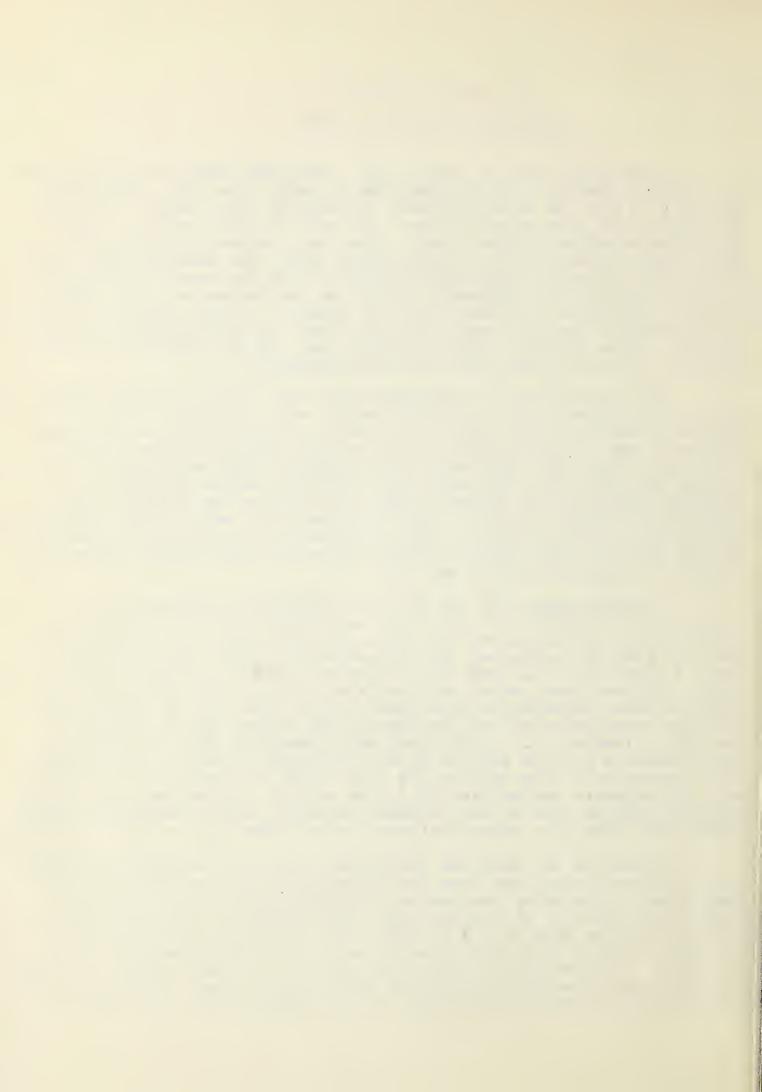
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Le la total roof ng. The mill building and a series of the first ore les milles and a series plant was completed or contracted in June 1907 and the entire plant was completed and contracted in June 1907. From 1909 to the purpose of the series and six and any extensive crance many in the mill years will be taken up by density and the level of the mill result of the contracted and the discussion and the mill selection of the discussion and disc

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Liectric power for the cell is originally constituted by the conservation of 17 0 0 horse-core to the mill, but this clent we shat the consent contracted for hydro-electric Light Co. The ower plant equipment leins 419 horse-power water tube boiler equipment leins 419 horse-power water tube boiler equipment of the local second contract of 1500 kilovatt 2. Organization of 1500 kilovatt 2. Organization of the second contract of the concrete makestacks 180 him and In 1923 three or four of the boilers of the second contract of the second contract of the second contract of the concrete makestacks 180 him and In 1923 three or four of the boilers of the contract of the

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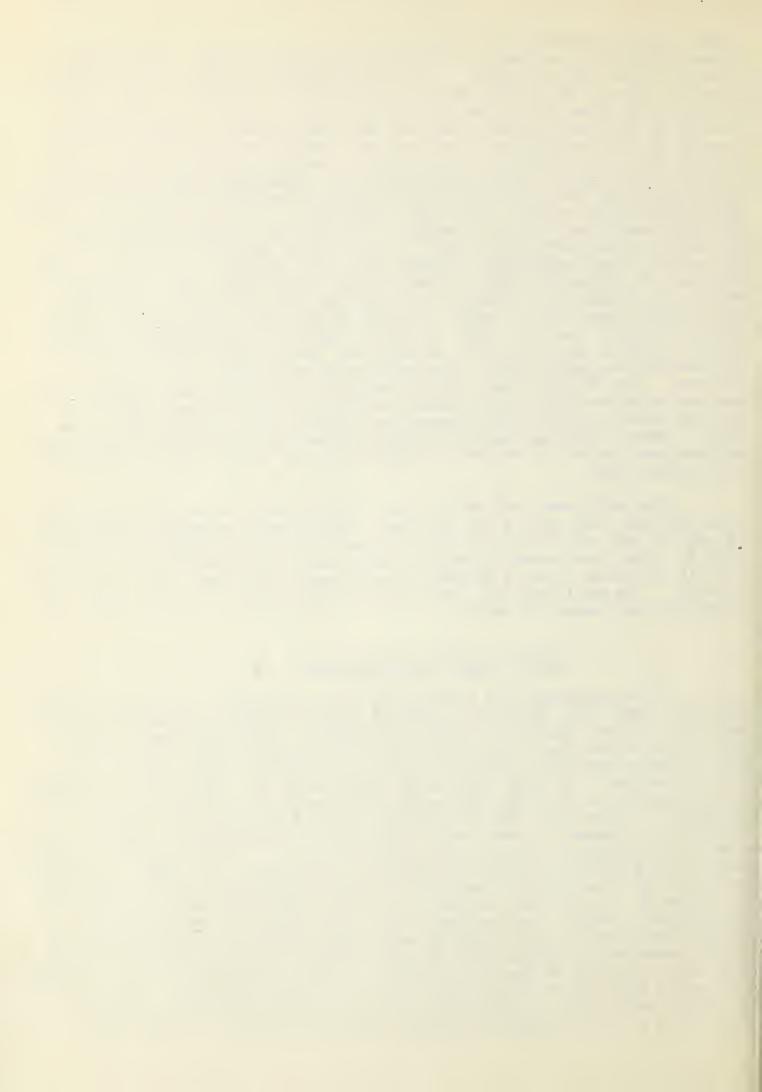
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Whree Jiron Sankson vamor 10.000 cellon occasion with and Jackson 5,000 walker pames. . 10,000 Berdher, hetclassemming.... The supply of veter angular transference and as the formation of razand at intere , In the Tah rat pat, take the Tah management outsting for irrigation outstand, and markets when the control of the last of the last of the control of the last of the control of the contr eside to a disas, and orthog at a decelored the same to duraly both the Larne out trans places the i do se as an uniliary supply. The curat discussed that the many to the i. 1/11, and 'ron heart to hea through 3 and 42" stars face man country has benul open, aspecially a ring has slow thousand the couth. To eliminate some or bila ringer and are en borton and siass, for a distinct of the and of the the period from 1913 to 1917. In the little and the manufacture is Birel conveyor was installed in the conveyor and a 1919 to remove clocks of the line, and wone to the tree of it readled the pump house the an install and an install and the pump house ollova. the single-stage 10, 00 sellor and the same selections and one single-stage 5,000 failon community and in the stage of the st listin, tates to the legal reservoir terms /30 cm to the many pige Three 5,000 gallon orther to the time and the time Jackson pump send the veter of that the send that the send the sen Tood stave pice.

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# COARSE CRUSTELL LIST OF

This department as ordered to the second of ore bin, with three stendard was about the second second There the 50 ton steel ore was were the the there are Then remanorted from the same of the same r7-1/2 Wites gratory erasings will be the same and the same and the same areas will be the same and the same areas will be the same and the same areas will be the same areas and the same areas are also as a same areas are also as a same areas areas are also as a same areas ar - 36" bucket elve tors, 607 mail ers. in 1907 the trommel service was a common to a service with oromacla i ving hold no see one con in 1911 in or 1-1/10 acresis of 5/8" ates wire wire of the form of the first o truck and 24 steel normal esourt 2 -10 4 51 mars and the and raise to 4 - 18 bell converges. t e andersise direct to the fine of the line of the li risely are in 2-1, " one in the limit of the second and 14" opening grissling on the As-ak /loop should be at the Hock over 14" in stan was then belon or a more than will constant all except one payment whose the second as the devoters conveyors with 1077 asphers coplants has SMY contillate to wind and a - 16" somewhere with 192" municipal residence of



Appropries to the conveyors and the conveyors and the second HOLL STORES, SINGS THE 50" SLAVE OF SE TOLLOW SERVICE STORES There of you have been and the service of the servi WERE DILL THE RECEDES INTO LAND TO THE PROPERTY OF THE PROPERT erotion on the A 36' convergers 17c' long necessiveses and 12 line more 50 I 20" rolls were installed in 1914 at all sers encor and b more 70" conveyors were gold to the under the contract of the At this time 2 - 15 ton Milm trams merm institled to make the Coarse crushing united In wild the west of remodeling the pass of the or unit 2 of the accomism coers constitue whent we illerton and of 12 conveyors relaced by a playerors character at the content of 4 - 36" and 4 - 30" Fore sets of 72 L 20" Cardell roll per to the four suto of 54 a col to le situation in the color at the ing towars, with amounting willow features were will in the same towers there are 16 - 4' masks ichaor bersent in 7-4syratory crushors were la in place for temporary one of the same cry normans were added as on the 50" rolls loss number to lentered to do all the secondary crus me with a will depusite at a work on As . and therefore, when a primary remains the management of is finished, the course was ins, rive and a constant

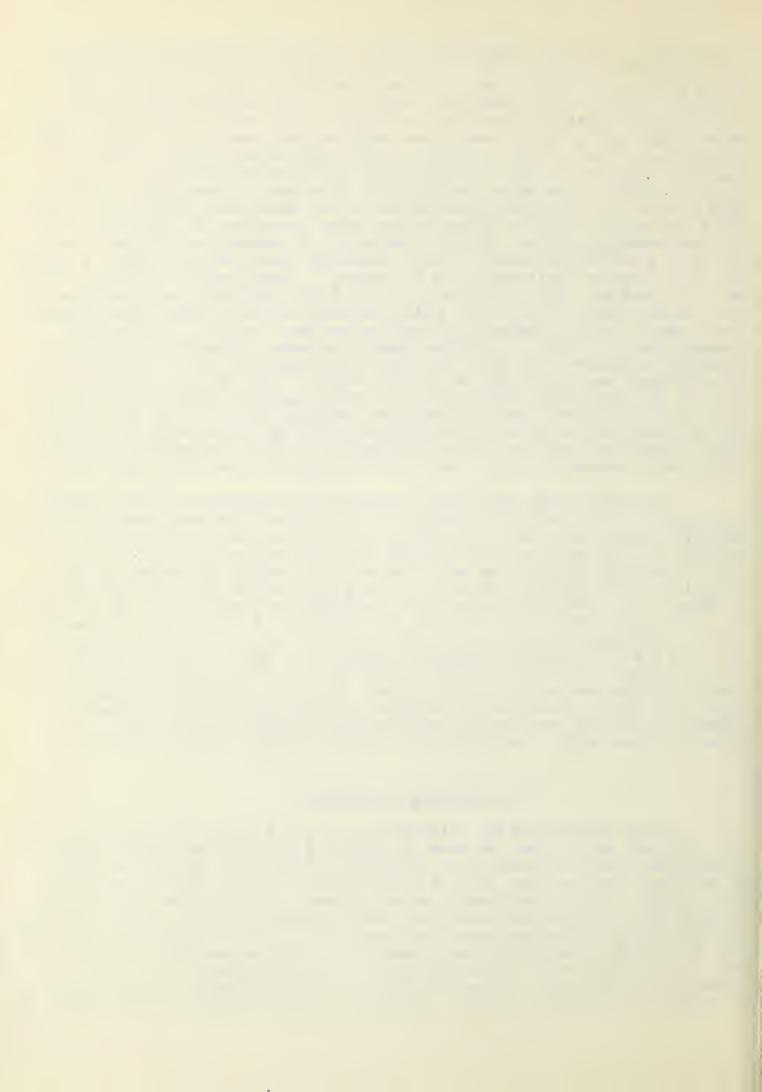
In April 1923 we has some to the problem of the pro

17-1/2 crushers and the spire of the cold to a second or of the cold to the co

# THE CRUEH INC WELLS TO LA

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The anded, whinh a total of 72. In July 1917 the content was storted. This change was med assumed that the mills was storted, which required was life than necessary heretofore, and artly to long the concentration. Two electic craves were last limit.

It and one 15 ton I and X. total of 36 - 7! In the content of the cont

## GRAVITY CONCENTRATIO DEFENDANT

In 1910, the Truylor jis having from the distributed and metallurgical view oint. 72 Carliell and the blue to the place of the jig. At the range time, the freeze alless it was a least to the place of abandoned and in their place 18 lines to the state of the classifiers were installed. The expression shows I have this chare. In 1911 24 additional about the character is a second to the character of firs were installed as amountary elections on the word affect vanier floor, and 24 more // military finishing to the second seco time return pumps were not in the second warmen ? The second management and the second managemen tenl overflow. This was purely on account of weather where the man attempt to recover from mireral flooting ever the some case. In 1911 to 1912 a retraction to the interest of the sections, and for this purpose 4 high vois- warmer / and of the and 8 "ilfley tables were acded, while it inhabites remain more use already in use were changed over to retract int more than the change was to produce a method produce of something to the limit of the smeller. This line will rive gother marine to make the insoluble material in the concentrate. The automout 111 in the concentrate in arially managed the single want to the single warmen and the single warmen and the single warmen are single warmen. E unelter penalty and po no pale on manufacture



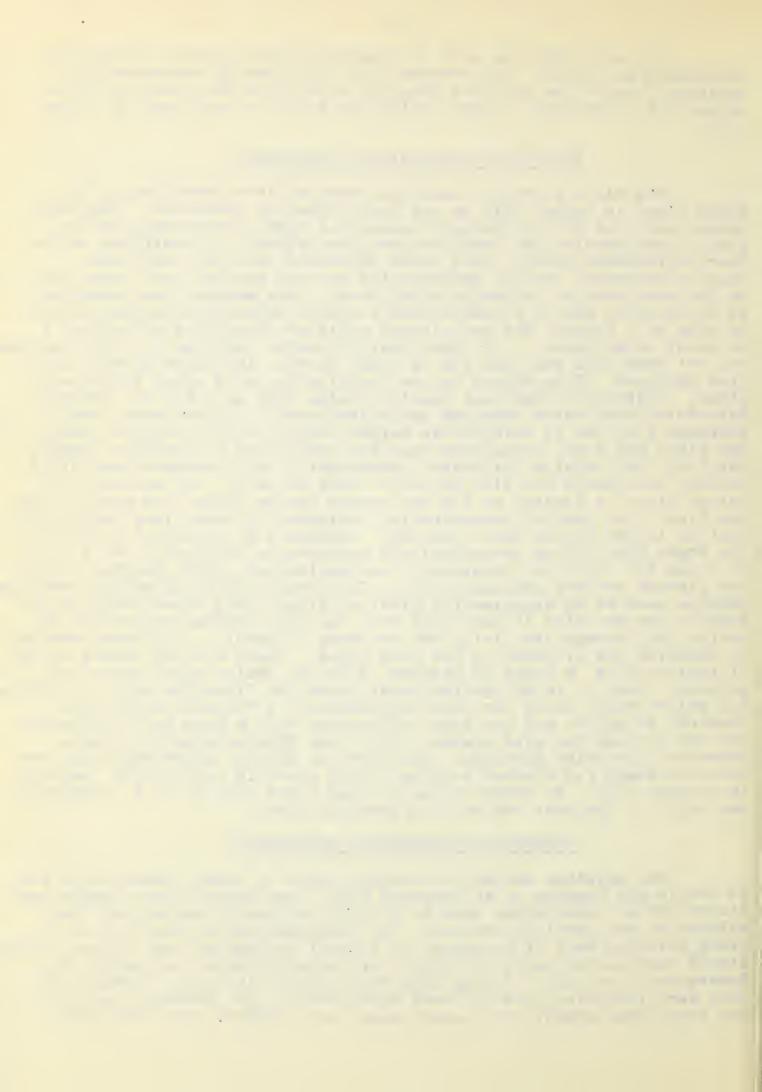
In April 1922 the work of dismantling the gravity concentrate department was begun. By November 1922, all gravity concentrating equipment except 144 Garfield roughing tables and 48 wilfley finishing tables was dismantled. These tables are still in use ahead of flotation.

#### FLOTATION CONCENTRATING DEPARTMENT

The first flotation machines were put into operation at the Wagna plant in August 1914 on the third floor of section 6. They were Janney machines of the straight mechanical type. This experimental plant first handled the overflow from the hydraulic classifiers in the four retreatment plants, this being thickened in a 44' Dorr tank. Shortly afterward another experimental machine was put into operation on the same section to handle slime feed. This machine was converted to retreatment and in November 1918 a Janney Magna type mechanical-air machine of 9 rougher and two cleaner cells was installed on section 1 to treat slime feed. A 20' Dorr tank thickened the feed for this machine. The 44' Dorr tank was torn out in 1922, as were the experimental flotation machines. Preliminary to the installation of a slime flotation plant, construction work was started during 1918 on a 225 ft. concrete thickening tank which remained unfinished when the plant shut down in February 1919 due to unfavorable market conditions for copper. Then the plant was down, plans were made for installing a flotation process which did not require thickners, consequently this concrete tank still remains unfinished and will probably never be used. The present flotation plant is located on the old second vanner floor, and partly into the first, the gravity concentrating equipment on this floor, except 48 Wilfley tables having been torn out. There are 48 rows or 8 sections of the Magna type Janney mechanical-air machines on sections 3, 4, 5, 6, 7, 8, 9 and 10. Each row consists of one emulsifier, eight rougher cells, two cleaner and one recleaner cell. They were modeled after the same type machine used as an experimental plant at Arthur, but after being in operation for sometime it was found that the machine was not capable of taking the tonnage nor giving the recovery it should. This was remedied by changing the circulating and feed pipes. There are 576 motors on the flotation cells, 6 Roots #8 blowers, 2 37,000 gallon steel tanks for sulphuric acid, 2 14,000 gallon steel tanks for flotation oil, 4 auxiliary 800 gallon steel tanks for acid distribution, 2 variable speed acid feeders, 12 pulley and pan type oil feeders with a pump for circulating the cil through the pipe system. Six 2 ton Sprague electric cranes serve the flotation machines. There are 12 Wilfley slime pumps and two concrete sumps for cleaner tailing. This plant is practically complete in October 1923. To carry the extra load a new 7500 E. V. A. substation was built at the west end of the flotation plant.

# CONCENTRATE DEWATERING DEPARTMENT

The original method of handling table or vanner concentrate was to settle and dewater in 16 concrete bins, from which it was loaded into filter bottom concentrate cars by a 3-1/2 ton Gantry crane, and then shipped to the Garfield smelter. The introduction of flotation and finer grinding made it necessary to install thickeners and filters, since simple decantation would not give a dry enough product to handle, and losses would be high. During 1917 and 1918 two 14' x 22' Portland filters were installed; two 75' Dorr thickeners; a 36" elevator for filter feed; two Gardner-Rix vacuum pumps, and conveyor belt for loading



filter product into cars. In 1923 six more 75' Dorr thickeners were installed; eleven 14-1/2' - 4 leaf American filters; two sets of 2 spigot Richards-Janney classifiers to handle lifley concentrate; four 6' Witchel type drag classifiers, used as dewaterers; two 27 x 14" Ingersoll-Rand vacuum pumps; two 36 x 20" Ingersoll-Rand vacuum pumps; and four automatic electric concentrate samplers. There are two 20" conveyors 200 and 300' long; 2 - 30" conveyors 200 and 300' long, and two 18" twin bucket elevatos. The Portland filters, vacuum pumps and equipment were dismantled in July 1923. The 3-1/2 ton Gantry crane will be obsolete when all changes under-way are completed, and the concentrate bins will be used only for additional settling space for Dorr tank overflow.

SUITARY

When changes under-way in 1923 are completed the original coarse crushing plant will have been almost entirely replaced, except for 4 sets of 54" x 20" rolls; the bins, crushers etc. all being obsolete. The fine crushing machinery will all have been changed from the original installation, the bins only remaining. In the gravity concentrate department none of the original installation will be left, except some of the tables. 144 Garfield rougher tables and 48 Wilfley finishing tables will still be in use, but the Garfield tables were added in 1910. The flotation department entire is a 1923 addition, and the concentrate dewatering plant is also entirely changed, except for the original 16 concentrate bins. For making these changes there were only two major reasons, to increase tonnage or to improve the metallurgy. Increased tonnage caused nearly all changes in the crushing departments, while in the concentration departments the principal changes were made to improve the recovery. It was very rarely that the equipment as installed failed to do the work expected of it at the time. The tonnage per day has gradually increased from the 6000 planned on in 1907 to possibly 24,000 in 1924, while the percent extraction has increased from 65 to 80.

## SHOPS AND BUILDINGS

Accessory Buildings

The main office is a two-story brick building 50° x 50° built in 1907. In it is the emergency hospital, Magna club rooms, and offices for the superintendent, assistant superintendent, field engineer and matallurgical department.

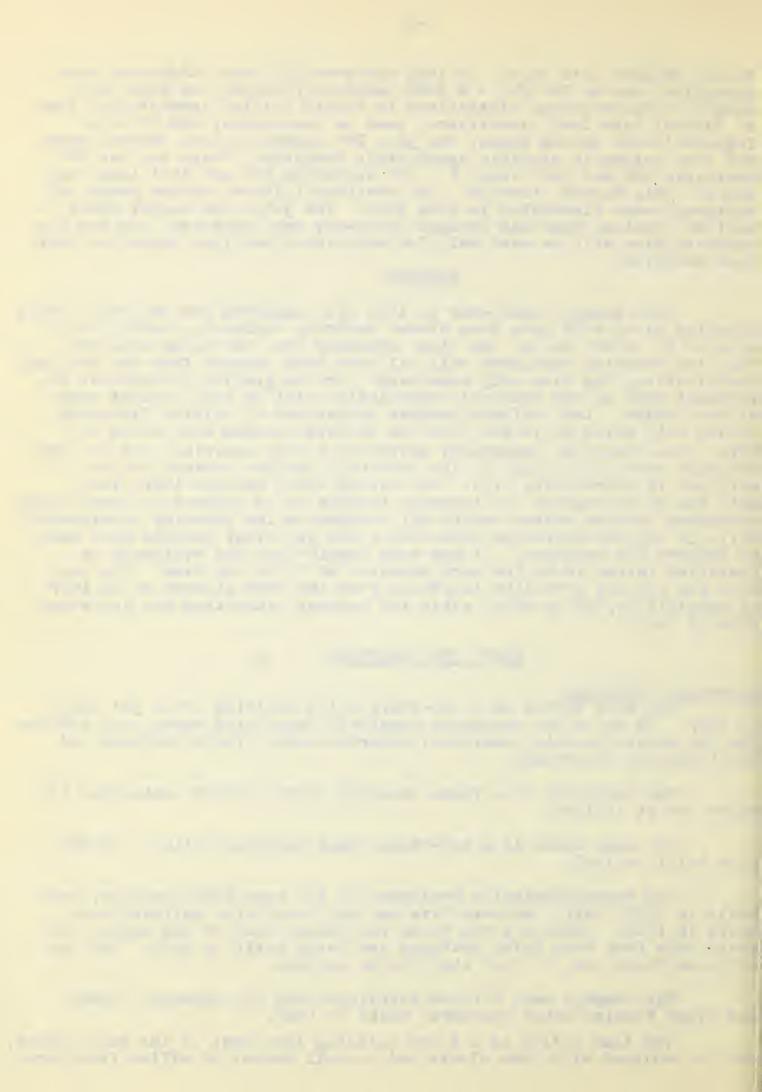
The dormitory is a frame building 94'6" x 34'2" containing 13 rooms, built in 1907.

The mess house is a two-story frame building 41'10" x 30'10" also built in 1907.

The superintendent's residence, a six room brick cottage, was built in 1918, while ten more five and six room brick cottages were built in 1920. There are two frame residences east of the plant, and seven more four room brick cottages are being built in 1923. For the cottages there are 3 - four stall brick garages.

The company owns 8 frame buildings used for Japanese, Greek and other foreign labor quarters, built in 1912.

The time office is a frame building just west of the main office, and is equipped with time clocks and a small amount of office furniture.



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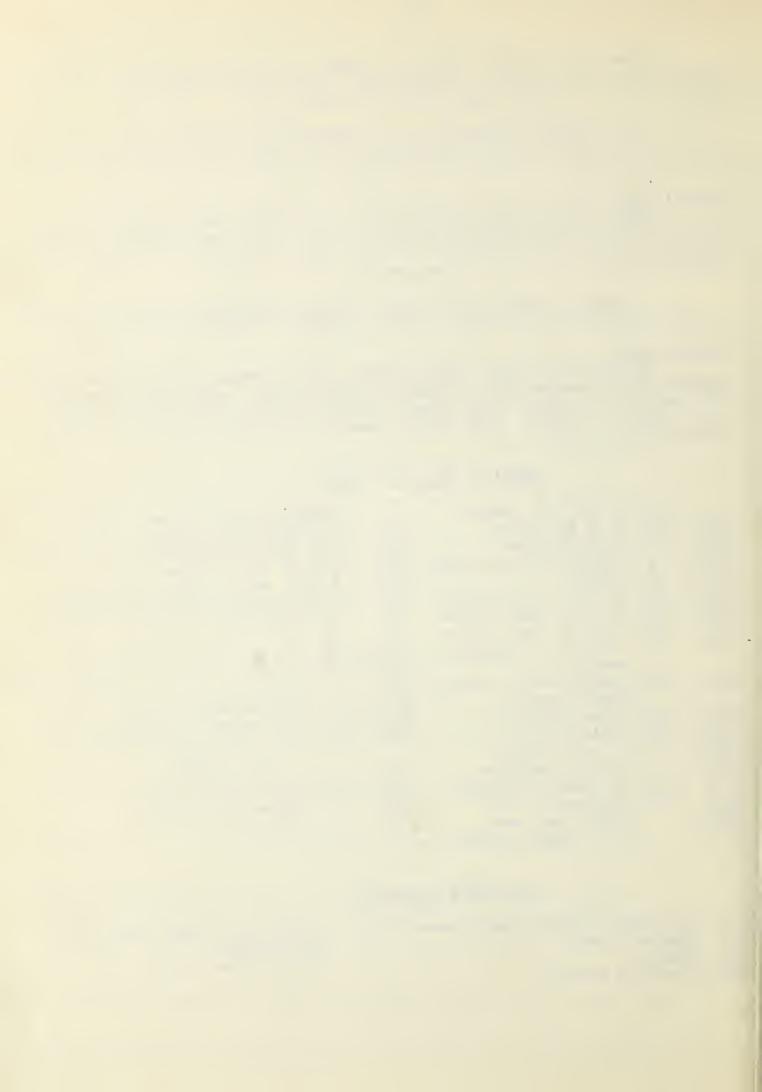
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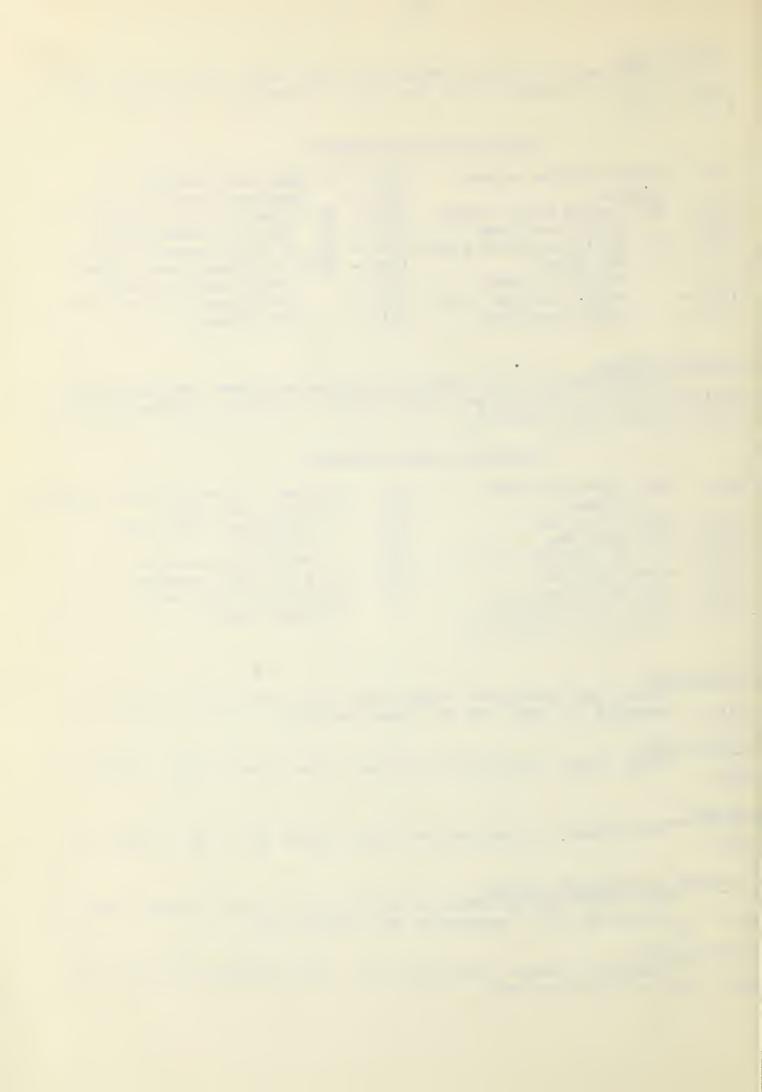
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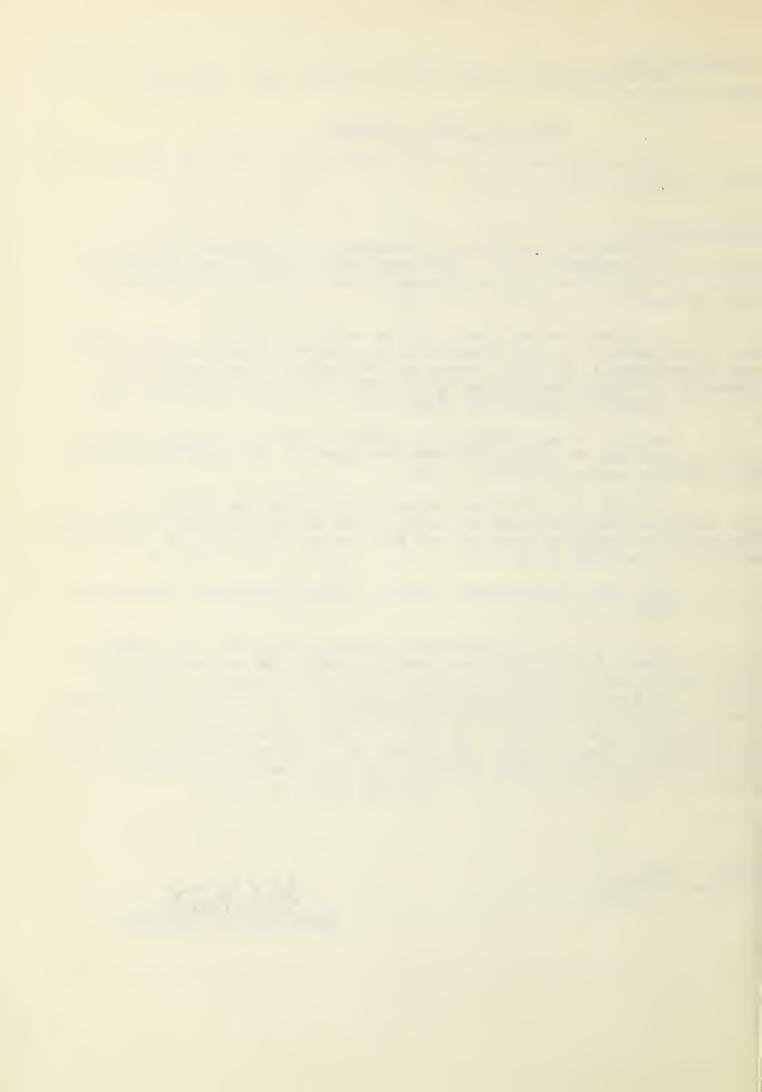
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Catoner 11,1923

H.J. Martin



#### UTAH COPPER COMPANY

#### HISTORY OF THE LEACHING PLANT

The Leaching Plant is situated just South of the Magn. It was built to lauch the oxidized ores and capping from the mine at Bingham, the mineral in which could not be saved by gravity or flotation concentration. Construction work was started in September 1916, and in (ctober 1917) the first ore was crushed, but cracks formed in the leaching vate delayed regular operation till January 1918. It was operated until February 1919 and then shut down until May 1920, when operations are resumed. In December 1920 it was again shut down, and has not been operated since. The shutting down of the Leaching Plant was primarily due to the deflation of the copper market, immediately following the war.

#### CRUSHING DEPARTMENT

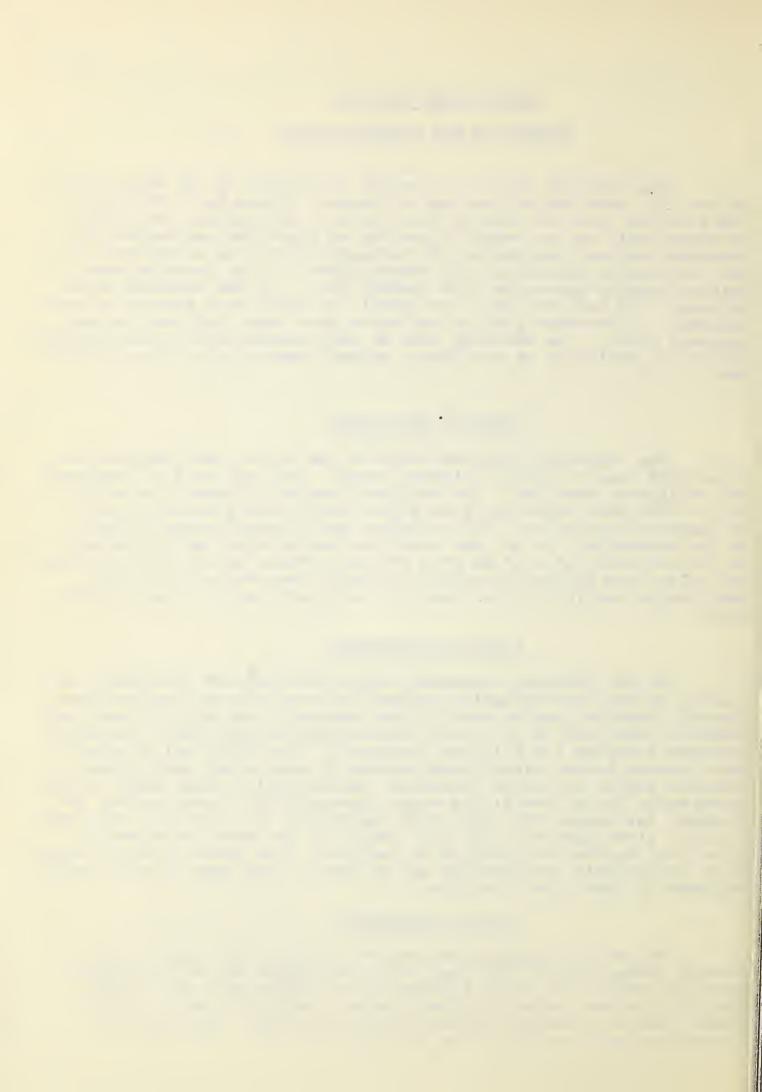
The crushing plant was built in two units, each desired to crush 4000 tons to 1/2" in sixteen hours. Only one unit of conveyors and rolls was installed. The equipment was as follows: A steel are bin of 1880 tons capacity, with 9-3/8" horizontal grizzlies, and 3" 40 degree grizzlies; 2 - 42" conveyors and 16 steel apron feeders on the undersize; 2 - 60" pan conveyors and 16 steel apron feeders on the oversize; 1" x 1" or 1" x 2" wire screens thead of the crushers and rolls; two #6 Gates gyratory or where; two sets of 72" 1 20" Worthington Garfield rolls; four 42" contejors and a 30 ton electricarane.

## I EACHING DEPART IT

In the leaching department there were two 42" conveyors, one leading bridge with automatic tripper for distributing the or, one electric sampler; twelve mastic lined concrete ands of 4000 to a many drainage launders and fittings underneath; four 37000 gallon accorded at the solution pumps; two Byron Jackson of acid proof centrifugal solution pumps; two Byron Jackson of centrifugal booster pumps or the fresh water lines; two single stage Ingersoll-Rand compression, where two stage 1000 cubic foot compressor; and find 10" and solution lines extending the full length of the rate, with mastic lined iron valves and fittings at each value mastic lined fittings are not entirely satisfactory and in 120 a good many of these replaced by lead lined fittings.

### TAILING D. P.RT.T. T

The tailing department consisted of one lead or from one leading bridge with 125' upon, 10 ton converse and 40 or from the converse of the finds are leading to the converse of the finds are leading to the converse of the c



### IRRUPITATION DELATION T

In the precipitation department there are tralve 25" of x 6' mastic lined concrete precipitating landers, four doctaring birs 62'6' x 9'4" x 3'4" for dewatering the procipitatel copy.: thenty-seven wooden auxiliary precipitating landers but a first of the procipitating and a 75' Dorr tank. The launders were insufficient to procipitating the procipitating drums 7'4" x 8' are installed. The revolving wooden precipitating drums 7'4" x 8' are installed. The part unsatisfactory and expensive to operate, and term replaced by three 7' x 10' stall tube mills lined first with 1/1' local task in the airlies of wood and inside with cast copper rings. In 1973 tasks tube aills were taken out, the liners removed, and the mills put into operation as grinding rills at the agent flant. Then the tube allowers installed, the wooden auxiliary launders are town out the traction of the concrete launders used as settling has for the take will discharge. A Tay City steam locomotive crare ith 70' not make 43' of the electric magnet was used to hadde scrap ito. 62" C. ". lestric magnet was used in 1920, but was never used.

### GIMENAT

There was 750 t. V. . sub station at the reacking limit, where two 150 liboratt estinghouse mater-generator sets produced the direct correct used on bridges and oracle.

To permanent buildings, except in the plant itself, were erected at the leaching Flant. There was an office, store-room couldn't are reperter shop; all of these from buildings and first in the construction work.

Togra Plant October 15, 1923 H. Martin





